Ultrasound Point of Care Tool for Evaluation and Intervention

Pierre d’Hemecourt, MD

Ultrasound
High resolution for superficial structures
Multi-planar capabilities
Color Doppler

Dynamic Evaluation

Intervention

HIP
The Multi-layered causes of Pelvic Pain

Static Examination

Start Anterolateral: Sagittal Direct
  AIIS (Subspine Impingement)
  Capsule
  Labrum
  Calcification: labrum, rectus, capsule

Static Examination
Static Examination

Now turn probe in sagittal oblique plane.
Look at cam as well as pincer.
Effusion and note the orbicular fibers.

90% Sensitive
* Screening
Buck: Eur Radiol 2011

Static Examination

Now turn probe in sagittal oblique plane and view the anterior labrum to the psoas.
Static Examination

Labral Tears and Paralabral Cysts

Static Examination

Psoas Bursa

Static Examination

Short Axis
Rectus
Psoas
Acetabulum
Dynamic Examination

Impingment at 90:90 with internal rotation
Look at acetabulum and at Rectus F
Snaps and clicks

Snapping Psoas

Left hip at rest with posterior psoas tendon
Destandes et al, AJR 2008
**Psoas**

Hip Flexion Abduction and ER

![Image of hip flexion abduction and external rotation]

**Psoas**

Entrapment as it is brought back to neutral

![Image of entrapment as it is brought back to neutral]

**Psoas**

Sudden release

![Image of sudden release]
Diagnostic and Therapeutic Injections

Differential Injections

Hip IA first:
- Provocative tests
- Ropivacaine 0.2% and triamcinolone
- Repeat Provocative tests
- Psoas
Ankle

Directed examination
Where are the symptoms?

Posterior Ankle

Achilles Tendon

Gastrocnemius and soleus tendons
No synovial sheath
Paratenon
Kager’s fat pad
Retro-calcaneal bursa
Achilles

Soleus

FHL

Achilles LS

Posterior compartment

Tibia

Achilles tendon

Achilles LAX

Retro-calcaneal Bursa

Achilles insertion LAX

Bursitis

Bursitis MR

MRI - Achilles' tendon
Case
24 Y.O. Dancer with posterior ankle pain
Tender at Achilles

MRI
Recurrent Bursitis

Underwent PRP into Bursa

THANK YOU
Knee Injuries in the Young Athlete
Top 10 Facts

September 16, 2015
Theodore J. Ganley, MD
Director of Sports Medicine at
The Children’s Hospital of Philadelphia
Associate Professor, Department of Orthopaedic Surgery
The University of Pennsylvania School of Medicine

DISCLOSURES
I, Theodore Ganley, have relevant financial relationships to be discussed, directly or indirectly, referred to or illustrated with or without recognition within the presentation as follows:

• Volunteer: Reviewer/editor
  » The American Journal of Sports Medicine
  » Clinical Orthopaedics and Related Research
  » The Journal of Bone and Joint Surgery
  » The Journal of Pediatric Orthopedics
  » The University of Pennsylvania Orthopaedic Journal

• Volunteer - Advisory Board
  » IPOS – Int. Pediatric Orthopedic Symposium
  » ROCK – Research in OCD of the Knee
  » PRISM – Pediatric Research in Sports Medicine

• Paid Consultant
  None

Pivot – Pop – Pain
ACL Injury on the Rise

- Over 10 yrs
  - 914 ACL, 996 meniscal tears, 155 tibial spines
  - Tibial spine fractures (controls)

400% increase in ACL injuries (p<0.001)
Multivariate linear regression analysis

The Children’s Hospital of Philadelphia
2011 AAP
Girls - greater risk of injury!

Females > Males, Same Sports, Same Schools

Goldberg, Flynn, Ganley 2006

- Females - significantly greater risk/rate of these injuries relative to males.
ACL tears can be prevented

Ready Set Prevent
www.chop.edu/sportsmed
ACL tears can be prevented

Pediatric ACL Prevention Programs
can increase strength & performance

Theodore J. Ganley, MD
Jeffrey Albaugh, PT, MS, ATC

European Pediatric Orthopedic Society
Pediatric Orthopedic Society of North America
International Pediatric Orthopedic Symposium
Kids Ligament injuries…
Some (partial) will heal

Partial will heal…
Complete will not…
“My knee hurts after soccer”
“My knee hurts after soccer”

- Exam Findings
  - Tenderness
  - Quad Contracture

“My knee hurts after soccer”

- Management
  - Quad stretching
  - Ice after sports
  - Activity modification
***'s

TG’ s ABC’s

- Activity Modification
  - OK to play sports
  - Pain/Limping
  - D/C activities for the day

TG’ s ABC’s

- Activity Modification
  - OK to play sports
  - Pain/Limping – D/C activities for the day
  - D/C activities 3 - 4 days in a row
  - No sports 4 wks
**TG’s ABC’s**

- **B**racing

---

**TG’s ABC’s**

- **C**ontinued Rehabilitation

---

**Osgood-Schlatters**

- TG to dad “What did I say?”
- Dad’s response
  
  “Not Dangerous”
  “You really don’t know what it is”
  “Ok to go”
Teaching Sheets
On the Sports Website

Osgood-Schlatters Fact

- Teaching Sheets are valuable
- Now I say (after a complete discussion)
  “Not Dangerous”
  “Hand these forms to your spouse”
  “Ok to go”
Patellar Dislocation

“One-Time Dislocators”

Treatment:
- Evaluate for fractures (common)

Patellar Dislocation

“Amazing Fact”
- Brace/Cast & Rehab (ABC’s) – If no fractures
Pivot – Pop – Pain
Clinical Evaluation

• History
  – Initially asymptomatic
  – Later – Snapping/clunking/giving way

Imaging

• Plain Radiographs
  – Lateral joint widening, tibial cupping, femoral dysmorphism, tibial spine hypoplasia
**Imaging**

- MRI diagnosis
  - 3 or more consecutive 5 mm thick sagittal slices
  - Continuity between anterior and posterior horns
  - Thickened bow-tie appearance

---

**Imaging**

- MRI diagnosis
  - Transverse meniscal diameter ≥ 15 mm

---

**Discoid Lateral Meniscus**
is primarily a pediatric finding
Pain – Swelling – Gradual onset

Wilson’s Test
Knee ***

- **Location**
  - lateral aspect of MFC > 70%
  - Inferior-central lateral 15-20%
  - Patellar 5-10%
  - Trochlea <1%

***

- **Imaging:**
  - **Plain Films**
    - AP, Lat, tunnel views
    - Assess: Lucency, Size, Location, Loose Bodies

Osteochondritis Dissecans
Osteochondritis Dissecans (OCD)

- Etiology
  - Repetitive focal microtrauma
  - Ischemia
  - Abnormal ossification
  - Genetic/endocrine factors
Osteochondritis Dissecans - Fact

ABC’s

Smaller Lesions
Skeletally Immature
Younger Kids Age <12

Immobilization
Activity Restriction

Physical Exam Findings:

Where: Point maximal tenderness

Kid’s will point to the problem
Good News: We can do amazing things to fix kids knee
ACL tears in skeletally immature patients are occurring at an increasing frequency and treatment remains controversial:

- Non-operative measures carry an increased risk for further intra-articular damage
- Operative reconstruction raises concern for disruption of the physis and consequent angular deformity and limb length discrepancy

We developed and previously described an all-epiphyseal ACL reconstruction technique using a socket in the tibia to place the graft at the native footprint of the ACL. Recent equipment refinement allows for the all-epiphyseal ACL reconstruction procedure to be less invasive and less disruptive to the pediatric anatomy and physiology.


At 13 month postoperative visit in an 11 year-old male status post ACL reconstruction:

- No sign of growth disturbance on exam or radiographs
- No pathologic laxity, full ROM, and symmetric strength documented by Biodex System 3 (Biodex Medical Systems, Shirley, NY)
- Passed functional hop tests and completed CHOP-Ready. Set. Prevent. pediatric ACL prevention program
- Return to activities with functional ACL brace permitted

The rationale for drilling the femoral and tibial tunnels "inside-out" and using buttons to secure the graft is to minimize disturbance to the anatomy of the skeletally immature patient. We have found benefit in the use of this technique in prepubescent patients.
In Summary…

1) ACL Rupture

2) Osgood Schlatter’s
3) Patella Dislocation

4) Discoid Meniscus

5) Knee OCD
Our Goal
Prevent Injuries in all young athletes in all sports

Ready Set Prevent
www.chop.edu/sportsmed
Injury Prevention programs

Thank You
Acute Ankle Injuries of Young Athletes

Michael T. Busch, MD

Financial Disclosure

None pertinent

Consulting/Education

• Orthopediatrics
• Arthrex

History

• 13 y/o boy playing tennis
• “Rolled his ankle”
• Felt a pop
• Swelled quickly
• Severe pain
• Could not play
• No prior problems
• R.I.C.E. by school trainer
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Physical Exam

- Swelling
- Discoloration
- ROM
- Crepitation
- Weight bearing
- Stability

Lateral Ankle Ligaments

Severity Grading

- Grade I - min. structural disruption
- Grade II - partial disruption/stretching
- Grade III - complete disruption
Physical Exam: Anterior Drawer

![Anterior Drawer Image]

Differential Dx?

- Ankle Sprain
  - Garden Variety
  - Acute on Chronic instability
  - Underlying tarsal coalition
- "High Ankle Sprain"
- Fracture
  - Ankle (tibia, fibula, talus)
  - MT5 base, etc
- Ankle / subtalar dislocation
- Peroneal tendon dislocation
- ± Osteochondral injury of the talus

Static assessment vs. Injury

![Static assessment Image]
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Radiographs

When to order: “Ottawa Criteria”

What to order: 3 Views

• AP
• Lateral
• Mortise
• Stress Views
  – Chronic
  – Syndesmosis injury

“High Ankle Sprain”

> 5 mm “clear space” is abnormal

Slow to heal ± surgery
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Physeal Fractures

- Sprain vs fracture
- Weak link in the chain
- Clinical diagnosis!
  - Refusal to WB
  - Focally tender over the physis
- Radiographs
  - Bony element
  - Displacement
  - ± Soft tissue swelling

Foolers

- Accessory navicular
- Os subtibiale
- Os subfibulare

Accessory Ossicles

Michael T. Busch, MD
www.childrensortho.com
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Ankle Sprains

- Most common sports injury
- 27,000/day in the US
- Peak incidence 15-19 y/o

Youth Sports

- Extremely common in most running/jumping sports
- Frequency in Basketball: 70%
- Severe Grade: 32%
- Recurrence: 80%
- Rehab = Prevention
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Treatment

- Acute management
- Range of motion
- Strength
- Proprioception
- Return to sport

Acute Mgmt.

- RICE technique
  - Rest
  - Ice
  - Compression
  - Elevation
- Modalities
  - Ice
  - Electrical stimulation
  - Taping/bracing/cast?

Range of Motion

Active, Passive, Active Assisted
Pitfalls of the Young Athlete: Ankle, Elbow, and Wrist

Strength
- Isometric
- Isotonic
  - Concentric
  - Eccentric
- Isokinetic

Proprioception
- Affected by injury
- Start in early phases
- Advanced throughout
Return to Sport

• More than exercises
• Sport specific skills
• Vary the challenges
• Protect
  – Taping
  – Bracing
• Prevent re-injury!

Who Needs How Much?

Ankle Sprain Treatment Plan

<table>
<thead>
<tr>
<th>Not so bad</th>
<th>Geek</th>
<th>Jock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ace</td>
<td>R.I.C.E.</td>
<td>Rehab</td>
</tr>
<tr>
<td>Ice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rest</td>
<td>Brace</td>
<td>Early Return</td>
</tr>
<tr>
<td>Return</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bad</td>
<td>R.I.C.E.</td>
<td>Splint</td>
</tr>
<tr>
<td></td>
<td>Splint/cast</td>
<td>Cast</td>
</tr>
<tr>
<td></td>
<td>Self-rehab</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R.I.C.E.</td>
<td></td>
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<tr>
<td></td>
<td>Splint</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rehab</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Brace</td>
<td></td>
</tr>
</tbody>
</table>

Children's Healthcare of Atlanta
Primary Surgical Repair?

Highlights
• Comprehensive meta analysis
• No advantage to early surgery
• Most do well
• Rehab > no rx.
• Good outcomes with reconstructions
• Beware of concurrent subtalar instability


Summary
• Common injuries
• Common sense evaluation
• Most are simple, but there are fools and pitfalls
• Know your limits, but most are basic
• No single recipe for rx. selection
• Rehab = re-injury reduction

Michael Busch, MD
mtbusch@childrensortho.com
Admin Asst: 678-686-6820

Children’s Healthcare of Atlanta
Dedicated to All Better
Evaluation of Hip Pathologies in Young Athletes

VuMedi – Pediatric and Adolescent Sports Medicine
Yi-Meng Yen MD, PhD
Assistant Professor
Boston Children's Hospital
Harvard Medical School
Department of Orthopaedics
Division of Sports Medicine
Child and Adult Hip Unit

Disclosures

• Smith & Nephew (paid consultant); Orthopediatrics (paid consultant); AJSM Editorial Board

Anatomy

• Bony Anatomy
  • Pelvis – Ischium, Ilium and Pubis
  • Femur
  • Hip – femoral head and acetabulum
• Physis and apophysis
  • More prone to injury in the young
Anatomy

- Flexion
  - Iliopsoas
  - Quadriceps – Rectus femoris
  - Sartorius
- Extension
  - Gluteus Maximus
  - Hamstring
- Abduction
  - Gluteus Medius/Minimus
- Adduction
  - Adductors
- Internal/external rotation

Sensory Nerves

- Genitofemoral nerve (L1-L2) anteromedial thigh
- Obturator (L2-4) inferomedial thigh
- Lateral femoral cutaneous nerve (L2-3) anterolateral thigh
- Posterior femoral cutaneous nerve (S1-3) posterior thigh

Motor Nerves

- Obturator – adduction
- Superior gluteal – abduction
- Femoral – flexion
- Inferior gluteal – extension
- Sciatic – knee flexion

Anatomy

- Bursa
  - Prevent excessive friction of soft tissue over bony prominence
  - Tight tendons can cause inflammation with repetitive activity
  - Trochanteric bursa
    - ITB
  - Iliopsoas
Anatomy

- Intra-articular Anatomy
  - Synovial lining
  - Capsule
  - Cartilage
  - Bone
  - Labrum
  - Ligamentum teres
- Histology of pain receptors (Nociceptin, Substance P, Neuropeptide Y)
- Distribution of receptors on labrum, ligamentum teres and capsule
- Cartilage has no pain receptors
- Highest concentration at anterosuperior labrum and at chondrolabral junction

Other causes of hip pain
- Male and female sexual organs
- Intestinal tract
- Urinary tract
- Vascular structures
- Tumor
- Referred pain from back/knee

EVALUATION OF HIP PAIN
History

- Age
  - Pre-pubescent – Transient synovitis, septic arthritis, Legg-Calvé-Perthes
  - Adolescence – SCFE, FAI, Avulsion fractures
  - Young adult – Stress fractures, FAI
  - Older adult - OA
- Trauma – Fracture
- Constitutional symptoms – tumor, inflammatory arthropathy
- Mechanical symptoms – coxa saltans, labral pathology
- Activity related, sitting, walking, sports, exacerbating factors
- Relieving factors

Physical Examination

- Systematic – Standing, Sitting, Supine
- Always evaluate the hip if young patient complains of knee pain
- Always evaluate the contralateral hip

Standing examination

- Gait
  - Antalgic – decreased stance phase
  - Trendelenberg
  - Foot progression angle
- Leg length – Symmetry of iliac crests
- Spine evaluation
- Popping of psoas or ITB
- Beighton score
Sitting Examination
- Sitting posture
- Neurologic examination
- Seated straight leg raise
- Ludloff exam for psoas

Supine Examination
- Bulk of examination
- Palpation of bony structures
- Range of motion
  - Impingement free range of motion
  - Pain or decreased internal rotation is red flag

Provactive Tests
- Thomas
  - Test iliopsoas
Provactive Tests

- Ober
  - Tests for TFL/ITB

Radiology

- Order AP Pelvis NOT AP Hip
- Bilateral lateral radiographs (Frog-leg or Dunn lateral)
- MRI if suspect soft tissue injury, stress fracture or tumor

Pre-pubescent

- Transient synovitis
- Most common case of hip pain in children
- History
  - Recent trauma or viral infection
  - Acute onset of limp
- PE
  - Pain with internal rotation, logroll
- Labs to consider
  - CBC, CRP, ESR
- Prognosis
  - Self-limited, improvement with NS
Legg-Calve-Perthes

- Unknown Etiology
- Males > Females (5:1)
- Between age 4-8
- Hx
  - Insidious onset of limp with mild hip or knee pain
- PE
  - Plain with internal rotation, limited abduction
- X-ray
  - Flattened femoral head

Adolescent: SCFE

- Failure of epiphysis, femoral head slips posterior
- Hx
  - Acute – cannot weight bear
  - Chronic – limp with external rotation gait
- X-ray
  - Need AP and lateral

Adolescent – Avulsion Fracture

- Concentric or eccentric contraction with sudden “pop”
- Pain with stretch or active motion
- X-ray
  - X-ray usually definitive
  - May need CT or MRI
- Most treatment is non-operative
Adolescent/Young Adult - FAI

- Increasingly recognized as source of pain in adolescents
- Cam or pincer deformity or both
  - Likely develops during adolescence
- X-rays
  - AP pelvis, Dunn Lateral
  - MRI to diagnose labral pathology

Young Adult – Femoral Neck Stress Fracture

- Female athlete triad
- Hx
  - Groin pain with activity and weightbearing
- X-ray
  - Sclerosis in femoral neck
  - May need CT, MRI to diagnose
- Tension-side
- Compression-side
Evaluation and Indications for Operative Management of Clavicle Fractures

VuMedi Webinar Pediatric & Adolescent Sports Medicine: Current Concepts
September, 2015
Kevin G Shea, MD
St. Lukes Sports Medicine
St Lukes Health System
Boise, Idaho

Disclosures

• None – Financial

Epidemiology -

• 10-15% of all pediatric fractures
• Most Common fracture under 10 years of age
• This is a significant pediatric, adolescent, young adult problem
Epidemiology: Location

- Mid-Shaft - 69 to 82%
  - Most are displaced

History of Treatment – 1950-1990s

- Non-unions were thought to be rare for mid-shaft
  - 0.1% to 0.8%
- Mal-unions not discussed
- Open Treatment most common cause of Non-Union
  - Neer - 4.6%
  - Rowe - 3.7%

Clavicle Shortening and Poor Satisfaction – Adult Patients

- Worse Clinical Results with Fracture Shortening
  - Ledger et al JSES 2005
  - Lazaridez et al JSES 2006
Some Real Data – Prospective, Registry

- Robinson et al 2004
- Adults
- Risk Factors for Non-Union
  - Increasing Age
  - Female
  - Displacement
  - Commination

Data – A critical tool for patient centered care

- Data Starts at age 20
- Displaced
  - non-union: 8% and 18% male/female
- Displaced and Comminuted
  - non-union: 18% and 30% male/female

Data – A critical tool for patient centered care

- We don't have much prospective data on pediatric and adolescent patients
Higher Quality Data - RCT

- McKee 2007 JBJS
- Operative versus non-operative
- Displaced Midshaft
- RCT – ‘Adult’ males
  - Ages 16-45 years
- Operative Group
  - Improved functional Outcome
  - Lower rate of mal-union and nonunion

Adult Literature: 100% displaced mid-shaft clavicular fracture

- Obremsky, JBJS 2009
- 75% of all patients will do very well without surgery
- 25% of these clavicle fractures won’t do well
  - Shortening, non-union, mal-union
- How do we determine which ones won’t do well?

Systematic Review

- McKee et al 2012
- Meta-Analysis
- 6 Studies, 412 Patients
- Operative vs. Non-operative
  - Non-union rate higher in non-operative group
  - 14.5% vs. 1.4%
  - Symptomatic Mal-union rate higher in non-op
  - 8.5% vs. 0.0%
- Earlier Functional Recovery in operative group
- No evidence to support better long term outcomes in operative group
Functional Limitations after Clavicle Fractures in Adolescents?

- Schulz et al 2013
- Adolescents
  - 10 to 18 years of age
  - 16 patients
  - Isolated, completely displaced, shortened, mid-shaft clavicle fracture sustained between 2009 and 2011

Regardless of patient age, sports participation, and final clavicle shortening.

For displaced, shortened, mid-shaft clavicle fracture.

Excellent outcomes for non-operative treatment.

Clavicle Complications/Reoperations

- Leroux et al JBS 2014
  - Administrative Database
  - 25% reoperation rate
  - 19% hardware removal
  - Complications
    - Infection 2.6%
    - Non-union 2.6%
    - Mal-union 1.1%
    - Pneumothorax 1.6%

- Leroux et al JBJS 2014
  - Percent reoperation rate
  - 25%
  - Hardware removal 19%
  - Complications
    - Infection 2.6%
    - Non-union 2.6%
    - Mal-union 1.1%
    - Pneumothorax 1.6%
**Large Series of Pediatric and Adolescent Patients**

- Heyworth et al, AOSSM 2014
- 641 case, retrospective
- **Findings**
  - 82% non-surgical, 18% surgical
  - Non-union
    - 1/526 non-op
    - 1/115 operative
  - 0% infections
  - 13% symptomatic implants
  - 2% symptomatic mal-unions

**Conclusions**
- The surgical approach more common now, especially in older patients
- Complication rates were low for both operative and non-operative treatment
- Patient centered decision making is important

**Displaced, comminuted fractures**

**Where are we now?**

- We have much better evidence for decision making in "adults"
- Active adults may do better with surgery for first 6-12 months
- Long term benefits?
- Shortening – association with poor satisfaction?
Displaced, comminuted fractures
Where are we now?

• Operative treatment of clavicle fractures in young patients is safe - low rates of complications
  – Vanderhave et al, JPO, 2010
  – Mehlman et al, JPO, 2009

• Healing Rates in the skeletally immature is still not well known – but probably much better than adults

Surgical Indications

• Significant Skin Tenting
• Open fractures
• Soft-tissue interposition
• Neurovascular compromise
• Multiple trauma
• Floating shoulder
• Repeat Fractures

Relative Surgical Indications

Patient Centered Decision Making is Key

• Younger, active patients with greater than 1.5-2 cm of shortening?
• Severe displacement or comminution
• Sports
  – Cyclists
  – Throwing athletes?
• Hand dominance
• Female?
Future/Research Questions

- How many patients do we operate on to prevent one symptomatic non-union or mal-union?
- Prospective Cohorts
  - EMR
- RCT’s?
- Identify patient factors and preferences that direct patients into appropriate treatment path – adolescents and adults
- Data on outcomes and complication rates
  - Improved Patient Communication Tools
- POSNA/AOSSM – Ben Heyworth, Michelle Caird

Acknowledgments

- Ben Heyworth
- John Polousky
- Ted Ganley
- Don Bae

- Why treat something non-operatively when you can get the same result from surgery?
  - Steve Frick
Case Study: Radiographs

13 Year old Male
Closed fracture
Soccer
Non skin compromise

How would you treat this?

Now 17 Years Old – Chronic Shoulder Pain, and weakness

How would you treat this?
ORIF with Local Bone Graft

Non-Surgical versus Surgical Treatment

<table>
<thead>
<tr>
<th>Non-Surgical Treatment</th>
<th>Surgical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for Healing</td>
<td>Longer – average 28 weeks</td>
</tr>
<tr>
<td>Impact on shoulder function</td>
<td>Displaced fractures may heal with clavicle shortening, which may have an impact on shoulder position and function.</td>
</tr>
<tr>
<td>Non-union risk (fracture does not heal)</td>
<td>Higher</td>
</tr>
<tr>
<td>Cosmetics Issues</td>
<td>May have large lump or deformity in clavicle</td>
</tr>
<tr>
<td>Skin sensation</td>
<td>Non-significant changes to sensation</td>
</tr>
<tr>
<td>Infection Risk</td>
<td>None</td>
</tr>
<tr>
<td>Nerve/blood vessel injury risk</td>
<td>Very Rare</td>
</tr>
<tr>
<td>Impact on training</td>
<td>Riding a bike places significant loads upon the arm and shoulder, and the discomfort from the fracture may delay return to training.</td>
</tr>
<tr>
<td>Future treatment</td>
<td>If the fracture does not heal, surgery may be required to get the fracture to heal.</td>
</tr>
</tbody>
</table>

Figure 1

Middle Shaft Clavicle fracture, with 3 separate fracture pieces

Fixation with plate and screws
Case 2
Clavicle Fracture in 19 Year Old Cyclist – simple fracture pattern, with 2 fracture pieces.

Treatment with intramedullary pin

Non-Surgical versus Surgical Treatment

<table>
<thead>
<tr>
<th></th>
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<th>Surgical Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for Healing</td>
<td>Longer – average 28 weeks</td>
<td>Shorter – average 16 weeks</td>
</tr>
<tr>
<td>Impact on Shoulder Function</td>
<td>Displaced fractures may lead to shoulder dysfunction which may affect arm function</td>
<td>Fracture fixation restores shoulder position and function</td>
</tr>
<tr>
<td>Non-union risk (fracture does not heal)</td>
<td>Higher</td>
<td>Lower</td>
</tr>
<tr>
<td>Cosmetic Issues</td>
<td>May have large lump or deformity in clavicle</td>
<td>Surgical scar. In lean cyclists, the hardware may be slightly prominent</td>
</tr>
<tr>
<td>Skin Sensation</td>
<td>No significant changes in sensation</td>
<td>Skin sensation may be affected</td>
</tr>
<tr>
<td>Infection Risk</td>
<td>None</td>
<td>Most implant surgeons have a negligible risk of approximately 1%, even with appropriate preoperative antibiotic use</td>
</tr>
<tr>
<td>Nerve/Blood vessel/lung injury risk</td>
<td>Very Rare</td>
<td>Rare</td>
</tr>
<tr>
<td>Impact on Training</td>
<td>Riding a bike places significant loads upon the arm and shoulder, and the discomfort from the fracture may delay return to cycling</td>
<td>Usually allows return to training. Resumption of training or a race may occur in a few weeks or earlier after surgery</td>
</tr>
<tr>
<td>Future Treatment</td>
<td>If the fracture does not heal, surgery may be required to get the fracture to heal</td>
<td>Future hardware removal may be necessary if the implants bother the patient</td>
</tr>
</tbody>
</table>

Reference on Clavicle Fracture

- Nonoperative treatment compared with plate fixation of displaced midshaft clavicular fractures. Surgical technique.
- Altamimi SA, McKee MD; Canadian Orthopaedic Trauma Society.